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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 1, 2017/2018

### PPS0034 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Business)

16 OCTOBER 2017  
9.00 a.m. – 11.00 a.m.  
(2 Hours)

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#### INSTRUCTIONS TO STUDENT

1. This question paper consists of 3 pages with **FOUR** questions.
2. Attempt **ALL** four questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.
4. **Formulae** are provided at the back of the question paper.
5. **Statistical table** is provided.

**Question 1**

- a) Let the random variable  $X$  represents the number of **winnings** in an experiment with the following cumulative distribution.

$X$	-2	-1	0	1	2	4
$P(X = x)$						
$F(X = x)$	28/91	44/91	45/91	77/91	85/91	1

- i) Complete the above probability distribution. (3 marks)
- ii) Find the expected value and variance for the random variable  $X$ . (6 marks)
- b) The continuous random variable  $X$  has the following probability density function:

$$f(x) = \begin{cases} x^2 & ; 0 \leq x < 1 \\ a - bx & ; 1 \leq x \leq \frac{7}{3} \\ 0 & ; \text{otherwise} \end{cases}$$

where  $a$  and  $b$  are the constants.

- i) Given that  $E(X) = \frac{131}{108}$ , find the value of  $a$  and  $b$ . (12 marks)
- ii) Evaluate  $P(0.5 \leq x \leq 2)$ . (4 marks)
- (Total = 25 marks)

**Question 2**

- a) Siva is taking part in 6 competitions. If the probability of him winning any competition is 0.33, find the probability of him
- i) winning at least two competitions. (3 marks)
- ii) losing all competitions. (3 marks)
- b) Four persons, on an average per day, come to XYZ company for job interview. Find the probability that
- i) Less than three people have come for interview on a given day. (2 marks)
- ii) From 10 to 20 people have come for interview on a given week (weekdays only). (4 marks)
- c) The average wages for workers in a particular industry is RM6.50 per hour with a standard deviation of RM1.20. The wages are considered to be normally distributed.
- i) Suppose you are employed in this industry. What would your wage have to be if 75% of all workers earn more than you? (4 marks)
- ii) What is the probability of workers receive wages less than RM5.00 per hour? (4 marks)
- iii) What is the probability of workers make between RM6.00 and RM9.00 per hour? (5 marks)

(Total = 25 marks)

**Continued...**

**Question 3**

- a) Consider the following data on the operating hours per day for all air-conditioners in a building:

24      16      22      10      9      12

- i) List all the possible samples of size five (without replacement) from this population and construct the sampling distribution of the sample mean. Then, find the sampling error for each sample. (15 marks)
  - ii) If a random sample of 5 members : 24, 16, 10, 9, 12 was mistakenly recorded as 24, 16, 11, 19, 12, calculate the non-sampling error. (3 marks)
- b) A bottling company uses a filling machine to fill plastic bottles with a popular cola. The bottles are supposed to contain 300 milliliters (ml). In fact, the contents vary according to a normal distribution with a mean of 303 ml and a standard deviation of 8 ml.
- i) What is the mean, and the standard deviation of the sample mean of 37 randomly selected bottles? (3 marks)
  - ii) What is the probability that the mean of 37 bottles is more than the population mean by at least 4 ml? (4 marks)

(Total = 25 marks)

**Question 4**

A manufacturer claims that the thickness of the spearmint gum it produces is 1.5 millimeters. A quality control specialist regularly checks this claim. On one production run, he took a random sample of 45 pieces of gum and measured their thickness. He found that, the mean is 1.54 millimeters with standard deviation 0.09 millimeters.

- a) Construct a 94% confidence interval for the mean thickness of the spearmint gum, based on a sample of 45 pieces of gum selected. (7 marks)
- b) Using the 1% significance level, is the claim true? (12 marks)
- c) If the significance level is changed from 1% in part (b) to 0.1%, will the conclusion still the same as in part (b)? (6 marks)

(Total = 25 marks)

**End of page**

**Formulae:****1.**

	Mean	Variance
<b>Discrete Random Variable <math>X</math></b>	$\mu = E(X)$ $= \sum xP(x)$	$Var(X) = E(X^2) - [E(X)]^2$ where $E(X^2) = \sum x^2 P(x)$
<b>Continuous Random Variable <math>X</math></b>	$\mu = E(X)$ $= \int_{-\infty}^{\infty} xf(x)dx$	$Var(X) = E(X^2) - [E(X)]^2$ where $E(X^2) = \int_{-\infty}^{\infty} x^2 f(x)dx$

**2.**

	Formula	Mean	Standard Deviation
<b>Binomial Probability</b>	$P(x) = \binom{n}{x} p^x q^{n-x}$	$\mu = np$	$\sigma = \sqrt{npq}$
<b>Poisson Probability</b>	$P(x) = \frac{e^{-\lambda} \lambda^x}{x!}$	$\mu = \lambda$	$\sigma = \sqrt{\lambda}$

3. The  $z$  value for a value of  $x$ :  $z = \frac{x - \mu}{\sigma}$

4. The  $z$  value for a value of  $\bar{x}$ :  $z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

where  $\mu_{\bar{x}} = \mu$  and  $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

5. Sampling error =  $\bar{x} - \mu$

Non-sampling error = incorrect  $\bar{x}$  - correct  $\bar{x}$

6. Point estimate of  $\mu = \bar{x}$

Margin of error =  $\pm 1.96\sigma_{\bar{x}} = \pm 1.96 \frac{\sigma}{\sqrt{n}}$  or  $= \pm 1.96s_{\bar{x}} = \pm 1.96 \frac{s}{\sqrt{n}}$

7. The  $(1 - \alpha)100\%$  confidence interval for  $\mu$  is

$\bar{x} \pm z\sigma_{\bar{x}}$  if  $\sigma$  is known

$\bar{x} \pm zs_{\bar{x}}$  if  $\sigma$  is not known

where  $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$  &  $s_{\bar{x}} = \frac{s}{\sqrt{n}}$